

REMARKS

Claims 1-17 are active in the application. Claims 3 and 15 have been amended. Claims 18-23 have been added. Claims 18-23 correspond to claims 6 and 8-12, but
5 depend from claim 3 instead of claim 1. A check in the amount of \$54 is attached to satisfy the fee for additional dependent claims.

The specification has been amended in several places to correct spelling and grammatical errors. No new matter has been added to the application.

Claims 15 and 16 were objected to under 35 USC 112 for an antecedent basis
10 error relating to the phrase "reflection surface". Claim 15 has been amended to be dependent upon claim 3 to correct this error as suggested by the Examiner.

Claims 5, 6, 13, and 14 were considered allowable if written in independent form.

Claim 3 has been amended to more particularly point out the present invention by specifying that a beam waist is located at the reflection surface. This amendment is
15 supported by Figs. 6 and 7, which show the beam waist w_2 at the reflection surface, and by text at page 14, lines 17-20.

Claims 1, 2, 10-12, and 17 were rejected under 35 USC 103(a) as being unpatentable over US patent 5,701,373 to Oleskevich. These rejections are traversed.

The present invention is mainly directed to symmetric optical systems between
20 optical fibers (the invention may be applied to other forms), whereas Oleskevich teaches an asymmetric optical system. The present invention provides an optical coupling system that resists variations in optical coupling efficiency caused by lens imperfections, alignment errors, temperature changes and the like. Specifically, the present inventors have discovered that variations in optical coupling efficiency can be minimized by
25 locating lenses as far apart as possible while requiring the formation of beam waists. Under the claimed conditions, variations in lens positioning or focal length produce relatively small variations in optical coupling efficiency. Hence, the present optical system provides for greater flexibility in manufacturing tolerances, which improves manufacturing yield and reduces cost in the assembly of optical systems.

30 Claim 1 requires the distance $2L$ between the two lenses to range from $1.8L_{\max}$ to $2L_{\max}$ where $2L_{\max}$ is a maximum distance allowing beam waists to be formed at equal

distance from the two lenses. As explained in the paragraph bridging pages 8 and 9 of the application, according to the invention the distance between the lenses or the distance between the lens and reflection surface corresponds to the maximum distance allowing each lens to form a beam waist. The arrangement provides that the coupling loss changes
5 little even in the case where a certain degree of increase in aberration or defects occurs against an ideal optical system or in the case where the performance of the optical system varies due to an environmental change or in the case where there is a displacement from the ideal design condition. The distance claimed in claim 1 is a relatively larger value (as large as possible) compared to a distance between the lenses provided in a conventional
10 optical system. By taking a larger distance between the lenses, coupling loss changes little. Oleskevich only teaches an optical system in which an elliptic beam output from a semiconductor laser is converted to a parallel beam with a collimator and condensed with condensing lenses. In the Oleskevich optical system, there is no motivation of any kind to take a distance between the two lenses than is larger than usual, and certainly not in the
15 range specified in claim 1.

Furthermore, the invention makes it possible to insert an optical functional device between the lenses, as is set forth in claim 13 (which is indicated to be drawn to allowable subject matter). Oleskevich never teaches a spacing, as required in claim 1, which would allow inserting an optical functional device between the lenses.

20 Claims 8 and 9 were rejected as being obvious over Oleskevich as applied to claim 1, further in view of Trimmer (U.S. 2002/005787 A1). This rejection is traversed for essentially the same reasons as applied above. That is, Trimmer does not make up for the deficiencies of Oleskevich with regard to the distance between the lenses as set forth in independent claim 1, therefore, no combination of Trimmer and Oleskevich would
25 make dependent claims 8 and 9 obvious.

Claims 3, 4, 7, 15, and 16 were rejected under 35 USC 103(a) as being unpatentable over US patent 5,327,447 to Mooradian. These rejections are traversed. In short, the invention is different from and unobvious over Mooradian in that Mooradian does not disclose or suggest adjusting the distance between the lens and the reflective
30 surface in view of input Gaussian beam.

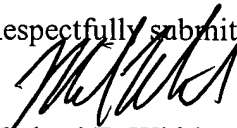
Claim 3, as amended, requires that the lens and reflective surface are separated by a distance close the maximum for a beam waist to form and that the beam waist is located at the reflection surface. Mooradian, by comparison, teach a different arrangement in which the lens is located one focal length from both the laser aperture and reflection surface (see Fig. 1(a)). With the lens located one focal length from the reflection surface in Mooradian, the beam waist cannot be located at the reflection surface. This is because, in order for a beam waist to be formed at the reflection surface, the distance between the laser and lens must be *greater* than the focal length of the lens, and the distance between the lens and the reflection surface must be *greater* than one focal length. Therefore, a beam waist located at the reflection surface, which is required in the invention and present claim 3, cannot be formed in the arrangement shown by Mooradian. Hence, Mooradian does not meet and cannot be modified to have the features of claim 3, as amended, and the rejection of this claim must therefore be withdrawn.

In view of the foregoing, it is respectfully requested that the application be reconsidered, that claims 1-17 be allowed, and that the application be passed to issue.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

A provisional petition is hereby made for any extension of time necessary for the continued pendency during the life of this application. Please charge any fees for such provisional petition and any deficiencies in fees and credit any overpayment of fees for the petition or for entry of this amendment to Attorney's Deposit Account No. 50-2041 (Whitham, Curtis & Christofferson P.C.).

Respectfully submitted,


Michael E. Whitham
Reg. No. 32,635

Whitham, Curtis & Christofferson P.C.
11491 Sunset Hills Road, Suite 340
Reston, VA, 22190

Phone: 703-787-9400

Fax: 703-787-7557



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